

**PREVALENCE OF SYMPTOMS AND ILLNESSES AMONG CURRENT AND
FORMER WORKERS IN SANDIA NATIONAL LABORATORY BUILDING 807**

ADDENDUM TO FINAL REPORT

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Prepared for Sandia National Laboratory Building 807 Management Action Team

**By the University of New Mexico Health Sciences Center
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Introduction

On December 5, 2001, the University of New Mexico presented summaries of its findings to the Employee Advisory Team and the Management Action Team at Sandia National Laboratories. During the ensuing discussions with these groups, several issues were raised:

1. What is known about the Building 807 occupancy experience of the Current Occupant group?
2. Is it possible to analyze the data to specifically consider the group of employees who currently occupy Floor 1 of the building?
3. With regard to the trend towards statistically significant elevations in the report of numbness and tingling in hands and feet, could analyses be repeated combining the data from the Current and Former Occupant groups?
4. Numbness in the extremities, particularly the feet, is perceived as an important symptom among Floor 1 occupants who consider themselves affected by the building environment. Is there a quantitative relationship between total years worked on Floor 1 and numbness and tingling in the feet?
5. In the prevalence survey conducted by UNM, symptoms of cough and phlegm were elevated among Former Building 807 occupants relative to the Never Occupant group. The analysis of short-term disability (5 day or longer absence) data performed by Elizabeth Ellis of Oak Ridge National Laboratory suggested an excess in absences due to obstructive respiratory disease. Are these findings congruent?

In response to each of these questions, the UNM investigators conducted additional analyses of the prevalence survey data and telephoned Dr. Ellis to discuss her methodology and findings.

Results

Building 807 Occupancy: Tables 6, 7, and 8 of Draft Final Report describe the Building 807 occupancy experience of the three comparison groups. At the December 5th presentations, members of the Employee Advisory Team were concerned that the sample of Current Occupants did not contain adequate numbers of persons who had occupied Floor 1 for substantial periods of time. To consider this concern, a table describing the distribution of occupancy time on Floor 1 is presented in Table A-1. Forty-six percent of the Current Building 807 Occupants reported no regular occupancy of the first floor. Fifty-four percent (53 workers) reported 1 to 20 years of occupancy on Floor 1, for a total of 365 person-years. Therefore, among the 53 current occupants who report some occupancy of Floor 1, the mean time is 6.9 years and the median is 6 years.

Table A-1
Distribution of Years on Floor 1 by Current Building 807 Occupant Group

Years	Frequency	Percent
0	45	45.9
1	5	5.1
2	7	7.1
3	3	3.1
4	2	2.0
5	7	7.1
6	3	3.1
7	3	3.1
8	8	8.2
9	2	2.0
10	3	3.1
11	2	2.0
12	2	2.0
13	0	0.0
14	2	2.0
15	1	2.0
16	0	0.0
17	2	2.0
18	0	0.0
19	0	0.0
20	1	1.0
Missing	3	---

Analyses Specific to Current Floor 1 Occupancy: During the planning phase of the prevalence survey, the working group discussed the limitations of conducting a statistically valid comparison of symptom occurrence among the current employees on Floor 1 and another comparison group. The small sample sizes involved and the likely low prevalence of symptom reports precluded the design of a cross-sectional study testing the hypothesis that excess symptoms were occurring in current Floor 1 population relative to a reference group. However, a cross-sectional prevalence study was a reasonable approach to quantifying the occurrence of symptoms among all workers currently occupying Building 807. In turn, if an elevated prevalence was observed and a case definition was established, then additional studies employing analytical design strategies (e.g., case-control design) could be justified to investigate the cause of the symptoms.

The limitations inherent in our approach do not differ from those of other mail surveys of symptoms in occupational groups. Workers at Sandia National Laboratories are potentially exposed to many different substances, even those sets of workers that occupy the same area or hold similar job classifications. The relevant hazards are difficult to identify, and in a self-completed survey, it is not possible to collect sufficiently detailed information on all of the

hazards that workers may have contact with. Without a case definition and without hypotheses as to the putative causes of disease, it was not practical to collect exposure information.

Combined Analysis of Current and Former Workers: During discussions with the Employee Advisory Team, it was suggested that data on numbness and tingling in hands and feet be combined for Current and Former Occupants. The combination of these data would increase the number of observations and may allow demonstration of statistically significant differences. Compared to the odds ratios presented in Table 16 in the original report, combining the data does not improve tests of statistical significance or the point estimate of the associations. The associations observed for the Former Occupant group drive the odds ratio estimates and significance tests. The test of numbness and tingling in both hands and feet (glove and sock presentation) for the combined data does not reach the 0.05 alpha level.

Table A-2
Odds Ratios and 95% Confidence Intervals for Report of Frequent Numbness or Tingling in Both Hands and Feet by Building 807 Occupant Group

Building 807 Occupancy	Symptom Present Often or Most of Time	Symptom Never, Rarely or Sometimes Occurs	Odds Ratio (95% CI)	p-value
Numbness or tingling in hands (irrespective of feet)				
Current & Former	25	175	3.12 (1.20-9.54)	0.019
Never	6	131	1.00*	
Numbness or tingling in feet (irrespective of hands)				
Current & Former	21	179	3.10 (1.10-10.76)	0.035
Never	5	132	1.00*	
Numbness or tingling in <i>both</i> hands and feet				
Current & Former	13	187	3.11 (0.83-17.27)	0.117
Never	3	134	1.00*	

*Reference category

Years on Floor 1 and Numbness and Tingling in the Extremities: The relationship between number of years worked on Floor 1 and the report of frequent numbness in the hands and feet was examined. To evaluate whether a dose-response relationship could be established for number of years of occupancy on Floor 1 and report of frequent numbness or tingling of feet, a logistic regression analysis was performed, adjusting for age and the number of years of employment at SNL (years of work experience other than on Floor 1 in Building 807). To obtain normality in their distributions, the number of years worked on Floor 1 and years of SNL employment were transformed by taking the square root. Among the Current Building 807 Occupants, statistically significant odds ratios could not be demonstrated for numbness or tingling in hands, feet, or both hands and feet (Table A-3). Similarly, no statistically significant odds ratios were observed among Former Occupants for numbness in hands and feet, and number of years worked on Floor 1. However, even though the confidence intervals were very broad and included the value of unity, the point estimates of the odds ratios were always above one.

Table A-3
Logistic Regression of Years Worked on Floor 1 and
Report of Frequent Numbness or Tingling in Extremities

*Current Occupants**

Variable	Odds Ratio	95% Confidence Interval	p-value
Hands Numb	1.57	0.74-3.33	0.239
Feet Numb	1.60	0.90-2.86	0.112
Both Hands and Feet Numb	1.26	0.74-2.15	0.406

*N=93. Of 101 current occupants of Building 807, 8 did not provide information on number of years worked on Floor 1, age, or years of employment at Sandia. Cases with missing data were excluded from the analysis.

*Former Occupants**

Variable	Odds Ratio	95% Confidence Interval	p-value
Hands Numb	1.42	0.82-2.46	0.209
Feet Numb	1.01	0.57-1.79	0.984
Both Hands and Feet Numb	0.96	0.47-1.99	0.919

*N=86. Of 99 former occupants of Building 807, 13 did not provide information on number of years worked on Floor 1, age, or years of employment at Sandia. Cases with missing data were excluded from the analysis.

*Combined Current and Former Occupants**

Variable	Odds Ratio	95% Confidence Interval	p-value
Hands Numb	1.31	0.90-1.91	0.165
Feet Numb	1.25	0.84-1.86	0.272
Both Hands and Feet Numb	1.18	0.71-1.97	0.526

*N=179. Of 200 current and former occupants of Building 807, 21 did not provide information on number of years worked on Floor 1, age, or years of employment at Sandia. Cases with missing data were excluded from the analysis.

Lack of Congruence in Findings of UNM and ORNL Analyses for Obstructive Respiratory Symptoms and Absences: Prevalence survey data collected by UNM indicated that symptoms of chronic cough and phlegm were elevated among Former Building 807 occupants relative to the Never Occupant group. Because the analysis of short-term disability data performed by Elizabeth Ellis of Oak Ridge National Laboratory suggested an excess in absences due to obstructive respiratory disease, further evaluation was warranted to understand what obstructive diseases were observed in the short-term disability database. Dr. Ellis states that this excess is attributable to six absences by one worker with asthma. If these repeated absences are excluded from her analysis, the rate of absence for respiratory diseases is reduced in the Former Occupant group, and becomes similar to the rate observed in the Never Occupant group (see Figure 8, Ellis 2001).

Discussion

In response to concerns raised by the Employee Advisory Team, we conducted additional analyses on the survey data to answer specific questions. Overall, the findings of these new analyses do not change our earlier conclusions.

Our analyses indicate that a substantial proportion of the Current Occupant group, 54%, had worked or was working on Floor 1. Among the respondents reporting some occupancy of Floor 1, the median time was substantial, approximately 6 years. Therefore, the survey does include a large number of workers who have spent substantial amounts of time working in the area of concern. However, it is not possible to conduct analyses of current Floor 1 occupants versus workers in other locations. The questionnaire did not ask about specific current location of work.

Additional analyses were conducted on symptoms of numbness and tingling in the hands and feet. In the initial analyses, risks for frequent numbness in hands and in feet were significantly elevated in Former Occupants relative to Never Occupants, however significant elevations were not observed for Current versus Never Occupant groups. The prevalence of frequent numbness in *both* hands and feet, although elevated in Current and Former groups relative to the Never Occupant group, also did not reach statistical significance. In the analyses performed for this Addendum, data for Current and Former occupant groups were combined to increase the number of observations and improve statistical power. A statistically significant increase for numbness and tingling in *both* hands and feet was not achieved with the combined data. Presentation of a “glove and sock” pattern of numbness is associated with peripheral neuropathies associated with exposure to several toxic substances, including heavy metals and solvents. Numbness in hands and feet alone, but not together, has lower predictive value for peripheral neuropathy associated with chemical exposure.

New analyses were conducted in response to suggestions to consider the number of years of work experience on Floor 1 and potential dose-response relationships for symptoms of numbness and tingling in the hands and feet. Multivariate logistic regression analyses were performed, controlling for the potential confounding effects of age and total number of years worked at SNL. Strong and statistically significant elevations in risk were not observed.

In our initial analyses, we observed an excess of symptoms of chronic cough and phlegm among Former Occupants of Building 807. Because the analysis of SNL's short-term disability data by Oak Ridge National Laboratory indicated elevated absence rates for chronic obstructive respiratory conditions, this issue was pursued. The high rates of absences in Dr. Ellis's analysis appear to be explained by repeated absences of a single employee for asthma, rather than absences observed in several employees and due to chronic bronchitis or emphysema.